Evaluating Feasibility and Selection of Computers in Family Medicine

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It is the rare family physician who has not thought about purchasing a computer for his home or office. This article will address many of the issues, concerns, and approaches that the family physician should take when evaluating potential applications and purchase of a computer for an office.

The specialty of family practice is well suited to computerization—there are many patients in the practice with frequent billing, there is not an overwhelming amount of information on each patient, and the data handling for billing and administrative uses takes a good percentage of the ancillary personnel's time. It makes more sense for family physicians to have computers in their offices than it might for surgeons (fewer patients and billing data), for internists (too much medical data), or for psychiatrists (fewer patients with a data base that is less well defined). A number of additional clinical and educational advantages that may be achieved by adding a computer to the practice have been described in earlier papers in this issue.

A Useful Approach

Define Current and Future Needs

It may be helpful, at least initially, to think of the computer as a black box and to try to identify the various outputs (printouts or video displays) that one would like to see. To help conceptualize the potential uses for a computer in a physician's office, this list can be arbitrarily broken down into billing outputs, administrative outputs, medical outputs, and research and education outputs. Previous papers have described and illustrated a variety of applications in all of these areas. One potential "wish list" (Table 1) summarizes most of the current uses for computers in ambulatory care. No single system provides all of them. In fact, most of these uses will have to be customized and programmed for any given setting.

Bobula[1] has suggested the following criteria to determine whether an information management problem might be amenable to computerization:

1. Frustration with routine or repetitious processes that must be done often (eg, preparing encounter forms)

2. Excessive time requirements to accomplish certain routine tasks (eg, typing insurance forms, letters, or manuscripts)

3. Need for a mechanism to compile, analyze, or display information necessary to make decisions

To introduce a computer successfully into a practice, a physician must be willing to change the way data are currently handled in the practice. To make this change may require more time and energy than estimated as well as some hard decisions that demand leadership, interest, and involvement. If interest and commitment do not exist, computerization of any function is unlikely to be successful. Many physicians like the excitement of dealing with new ideas or ways of doing things, but unless the group or organization is prepared to take on the procedural discipline to go through the following steps, it should be questioned whether the organization is ready for computerization.

Obviously, just to be ready to computerize some portion of a practice is not enough. The practice must also be able to afford computerization. The only demonstrated cost-effective tasks that computers can do in family physicians' offices are billing and keeping track of patient accounts. Many experts feel that it takes at least a two-provider practice or 75 transactions or more a day before a computer becomes competitive with a well-run manual billing system (eg, pegboard).

Examine Current Operations

After the wishes and needs, available funds, leadership, and commitment are assessed, the next step should be to examine the current operations to see whether procedures can be done more efficiently or more accurately without computerization. Present activities (eg, the flow of billing and medical data, staff responsibilities, the current

attainment of medical goals in preventive care, the current resident evaluation system) should be examined to determine areas that might be improved without computerization. It is important to calculate the cost of producing a billing statement in terms of personnel, mailing, supplies, and so on, to know how many insurance forms are sent out monthly, and to try to estimate the amount of lost charges. If the office is well run, if there are no major areas where computerization would help the

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Table 1. Potential Uses (Outputs) of Office Computers

Billing
1. Patient bills
2. Third-party statements
3. Delinquent balance reports
4. Aged accounts
5. Detailed analysis by source of payment/provider/procedure
6. Accounts receivable analysis

Administration
1. Patient registration
2. Patient scheduling
   Analysis by provider of no-show rates, cancellations, patients seen
   Pull list for medical records
   Preprinting patient charge slips/encounter forms
3. Patient statistics—Demographic
   Age/sex registry by provider
   Statistics by procedure or level of service (procedure code)
   Statistics by diagnosis (diagnosis code)
   Statistics by demography (ZIP code, occupation, etc)
   Statistics by provider
4. Ordering and communicating with laboratory/pharmacy
   Drug labels
   Printing prescriptions
   Cost analysis by prescriptions/laboratory procedure
   Calculating date patient is out of medications
   Drug-drug interactions
5. Patient recall visit reminders
6. Staff/resident schedule
7. Other administrative uses: accounts payable, payroll, general ledger, inventory

Medical
1. Medical history (entered by patient or provider)
2. Patient profiles (patient summary)
   Problem list
   Drugs currently or recently prescribed
   Recent laboratory results
3. Progress notes (coded vs free text)
4. Test results (flag abnormals)
5. Flow sheets
   Especially for chronic patients (eg, cardiology,

hematology, nephrology, arthritis, hypertensive), prenatal, or well-baby
6. Patient dispositions
7. Physician and/or patient reminders
   Preventive care
   Drug monitoring
8. Patient surveillance—preventive care needed
9. Total medical record (eg, COSTAR)

Research/Education/Other
1. Word processing
   Questionnaires
   Manuscripts
   Patient education sheets
   Referral letters
   Grants
   Manuals/reports
2. Games
3. Medical staff functions (for credentialing, proctoring, privilege renewal, continuing medical education hours)
4. Electronic spreadsheet (for budget analysis)
5. Data base searches
6. Patient simulations
7. Tests/questionnaires
8. Instructional programs
9. Biostatistics packages
10. Health hazard appraisal
11. Medical decision analysis
12. Family studies/continuity of care measurements
13. Documentation of resident experiences (procedures, scores, chart audit, rotations, curriculum objectives mastered)
14. References/bibliography
15. Quality of care studies
    Protocols
    Physician reminders with bibliographies
16. Interface with other computers/national data bases
    National Library of Medicine (Medline)
    Electronic mail
    Data sharing for research
    Access to off-site data
    Other national data bases (AMA/GTE, Toxline, Chemline)
    Airline schedules, Dow Jones

practice, and if no one has a burning interest in computers, then the decision is obvious. On the other hand, adding a computer to a disorganized, inefficient office is unlikely to improve the practice.

Define Characteristics of Desired System

Initially, it is important to distinguish between computers for the home or small office (microcomputers) and computers for a medium-sized or larger office (minicomputers). Although this distinction is becoming more blurred and may disappear in the future, presently there is still a logical difference between the two. The use of the microcomputer, with its standard programs in word processing, electronic filing (data-base management), and finance (spreadsheets), has been considered elsewhere in this issue. Medical billing packages are available for many microcomputers. The major problems with currently available microcomputers are inadequate storage, slow access to that storage, and the inability to link many terminals. Minicomputers have all these capabilities, and are, therefore, preferable for applications involving large amounts of information (such as in practices with more than four full-time providers who wish to do all of their billing, as well as other tasks, by an in-house computer). Although most of this article is applicable for either situation—minicomputer or microcomputer—it is directed more toward the larger and more complicated practice.

If billing is intended to be the prime function of the system and expansion into other areas (such as scheduling, storage of additional medical data, or research uses) is unlikely, there are many commercial systems available that will provide this function. In evaluating these systems, many points must be kept in mind. A suggested list of questions to ask vendors is provided in the Appendix, and the suggested reading list included at the end of this article may also be helpful.

After assessing billing and other administrative uses, patient scheduling may be considered for the settings of many physicians. Most of the commercially available patient scheduling systems are not impressive, however. The abilities to schedule patients quickly, to schedule multiple visits easily, to change the number of appointments per provider, to search for open appointments, and to keep track of missed appointments are important attributes to review. Some scheduling systems print an individual charge slip (which can be used

as a "super bill") for each scheduled patient. Lists for medical records to pull charts can be generated the night before.

If additional tasks with medical data are anticipated (eg, discovering which patients have not had their influenza vaccine or which resident has the highest frequency of tranquilizer prescriptions), the system chosen may well need some additional programming. The availability of technical assistance, through the vendor, a hospital, or a clinic, becomes an important issue. Programming always turns out to be more difficult than anticipated as well as more expensive. Custom programming and new system design should be avoided as much as possible.

A key item to consider in careful planning for the future is estimated computer storage needs. How many patients and how much information will be on the system in five years? In ten years? Particularly in dealing with a microsystem, underestimating storage needs in the future is a common problem. It is difficult to store more than a few hundred patient records on one floppy disk; and changing disks frequently can be tedious and time consuming. Hard-disk storage will probably be needed, and it is important to determine at the outset whether such storage can be added easily. It cannot be overemphasized that data collected should be limited to the essentials to decrease input and storage costs. Another issue in decreasing data storage costs is the question of which data are needed for immediate retrieval and which can be stored offline for later retrieval. If certain data are not needed for immediate retrieval (such as some registration or medical data), then it may be less expensive, both in system design and storage costs, to keep the data in another file.

Although having one system handle all the data is desirable, in many situations it becomes too expensive and cumbersome to try to redesign one system to cover all aspects of computer needs in large clinics. In this case, it may be preferable to have different systems for billing, word processing, and other functions.

The hardware needed must also be estimated: How many video terminals are necessary? How many printers will be used? Where will the computer be located? (Some minicomputers require their own rooms with air conditioning and a separate power supply, which is often very expensive. These needs may not be initially appreciated.) Is it easy to run lines between the terminals and the

computer? (Keep the lines as short as possible—less than 100 feet.) Will there be a loss of response time when everyone is using the system? (Most feel that the response time to an inquiry should be less than two or three seconds.) How is security handled? Who gets access to the data and how?

Evaluate Alternative Systems

If there is interest in leasing or purchasing a minicomputer system for a clinic, it would be considered standard practice to write a request for proposal and send it to a number of vendors. Obviously, this is not done when purchasing microcomputers. However, preparing a request for proposal and sending it to vendors is an excellent way to help specify exactly what is wanted in a system. The request for proposal does not need to be a formal document, but it should be a letter that includes such things as the characteristics of the practice, number of patients, number of providers, and number of bills per month. It should estimate the size of the practice in five years and attempt to specify the various applications desired. If special programming may be needed, it is useful to try to design how the output (the video display or the printed charts or graphs) would look. It is important to specify the time frame for design and installation and to estimate a range of costs. The vendor should be told to specify the hardware and the purchase price, lease price, and monthly maintenance cost for each component. The space and electrical requirements, as well as the implementation and conversion costs, should be requested. The vendor should be asked to respond with a description of the proposed system in layman's terms, to include a list of similar installed systems, and to provide a current annual report of the company. In addition, it is important to know how long the vendor has been in business and to see a list of the current number of medical accounts, which should be more than ten. In identifying potential vendors, information should be obtained not only from colleagues and conventions but also from local and state medical societies.

Initially, vendors may not respond with a formal written reply to a request for proposal, but may instead want to set up a meeting to demonstrate what they have available. It is important to approach these meetings in a frame of mind as detached and systematic as possible. Take plenty of time to view the whole system and bring some examples of billings from your practice for the vendor to put into the system. Take notes.

Frequently a practice may be considering a choice between a service bureau installation (such as a video display terminal connected to an offsite computer) or a complete in-house system. The advantage of having a video display terminal linked to a service bureau is that the capabilities of the system are known in advance. Service bureau hookup is preferable in areas where it is available if the person contemplating a system is a novice with computers and if the practice primarily wants billing services. A potential problem is that frequently the computer vendor may service many large accounts, and the physician with a small account may not receive the necessary attention or customization.

Generally a modular approach to computerization utilizing several standard software packages (including registration, financial billing and accounting, scheduling, and medical packages) makes a great deal of sense. It is important to be able to expand or to upgrade the system for additional nonbilling uses as needed at a later time. The selection of a computer system should be based primarily on the initial applications under consideration. If the evaluation of future needs has been done well, major system modifications should be unnecessary for a long time. However, planned system expansions should be considered and incorporated into the initial system as much as possible.

Once the choice has been narrowed to three to five systems, it is extremely important for the physician and his colleagues and staff to visit sites where similar systems are installed and in use. During these visits, ask many questions, including those concerning ease of use, staff acceptance, cost overruns, staff training, service, and recommended improvements. Obviously, colleagues and staff who may be using the computer system should be involved from the beginning.

Estimate Costs

No system should cost more than 20 percent of the yearly gross of the practice. This cost should be total cost, and include not only the hardware, but installation and other costs as well. As noted earlier, only billing services are thought to be cost effective, and even the implementation of computerized billing will probably not save money in

	Maximum Available Points	System		
		A	B	C
Accounts receivable	50			
Statement (billing)	20			
Practice management reports	10			
Word processing	20			
Other uses (scheduling, medical data storage, etc)	—			
Documentation of system	20			
Vendor support and reliability	30			
Expandability	20			
Hardware performance	10			
Ease of use	20			
Overall system costs	50			
	—	—	—	—
Total possible points	250			

Table 2. Sample Evaluation Worksheet

terms of personnel or other costs. As a billing service increases efficiency by decreasing the turnaround time of accounts receivable, the net effect may be some increased revenue or cash flow, and some decreased lost charges or accountant's costs. However, all other benefits would be classified as intangible. When comparing systems and costs, there is no simple formula to weigh different benefits in terms of what they should reasonably cost. It is necessary to look at the practice resources and situation to assess the importance of obtaining these benefits.

In addition, there are costs for hardware and software maintenance that may be as high as 15 percent of the system's purchase price. These maintenance contracts cover replacement of parts, field service, replacing equipment with loan equipment, if necessary, software package updates and programming changes, and so on.

If the customer is knowledgeable, a used computer may be purchased instead of a new one. The used computer market is growing, and some manufacturers will also sell their used equipment that has been maintained under a service contract with its original owner.

The decision to lease or purchase should be made with the consultation of a tax advisor. Minicomputers are often leased, and leasing should be a strong consideration, particularly for a first-time user. Microcomputers are usually purchased, but sometimes they may be leased. Some lease agreements allow a move up to larger equipment during the lease agreement, if that is needed.

Select the System and Sign a Contract or Agreement

First, the choice of systems should be narrowed to three to five, and then to one or two. The Sample Evaluation Worksheet (Table 2) can be used to help quantify decision making. If such a rating scale is used, the points or the criteria can be changed as needed for each particular setting and need. Formal contracts and definitive agreements should be signed only after the practice is ready to buy a system. Although there is nothing particularly different between a contract for computer equipment and software and a contract for any other large piece of equipment, some key points should be included in any contract.

Most important, services, not equipment, should be paid for. Nothing should be paid until the whole system is in acceptable working order. Any oral agreements related to the system's performance should be specified in a written contract. When dealing with multiple vendors, the person responsible when things do not work should be clearly specified. It is best to have one vendor responsible for sorting things out. The maintenance contract(s) (there may be two—one for hardware and one for software) should include field service within a specified time. Results rather than main-

tenance efforts should be specified. If replacement equipment is necessary to keep the system functioning, it should be readily available.

The contract should define all guarantees, warranties, and services. It should provide recourse for both parties (for example, if the vendor goes out of business, all source programs should be available in escrow if necessary, or if the practice should decide later to terminate the agreement, all practice information should be available on paper and in an easily machine readable form). The agreement should cover payment terms, include dates for installation and operation, detail training to be provided, and specify postinstallation support. Most computer consultants do not recommend signing a standard contract; for instance, one should not make a final payment (or give final agreement) until two monthly statement-processing routines have been carried out successfully.

An accountant and an attorney should review the contract, particularly concerning implications for vendor indemnity liability and insurance coverage of the clinic for potential loss of the equipment, losses due to the unavailability of the system, or losses if the system accidentally erases practice files.

Implement the System

Adequate preparation before implementing the system is essential. Any new equipment or software should be fully tested outside the practice by the vendor. Time should be taken to give the staff job-security assurance and encouragement to learn new tasks (especially to improve their typing skills), since it is unlikely that computers will reduce personnel. Time is needed for the staff to learn the new tasks. New forms may be necessary, and there should be adequate time to test these forms before they are put into use. Again, emphasis should be on keeping the forms as simple as possible. If an encounter form (billing and administrative data) takes more than 20 to 30 seconds for a provider to fill out, the procedure is likely to generate significant resistance.

Written documentation of how to use the system, with its functions clearly specified and every step and operation clearly written, is another key element. This documentation should include a full system and program description, operator instructions, screen output examples, and all operating and backup procedures. Training manuals and the availability of training to the staff are essential.

Tailoring the physical work environment to make the computer more compatible with human needs is also important. Most video terminals are now designed with a green background, which reduces eye strain. However, the terminals must be placed where they are easy to view, on eye level, and with the keyboard at a convenient height and position as well. Some machines now have detachable keyboards. Overhead lights should not produce glare on the screen. Printers are noisy and probably should be placed away from patient care areas. The issue of who does the backup tapes each day and where they are stored must be addressed. Fire protection, air conditioning, and power needs must also be reviewed. If the computer is to be located in more than one area, it first should be implemented with personnel who are most comfortable with it. Some resistance to the computer will undoubtedly occur. Often, beginning with a game or two will ease initial insecurity in dealing with the system.

There should be a test period with parallel operations of both the new and the old systems. Often this test period is continued for months. It is not unusual to have the computer hardware installed for three to six months before a system is fully implemented. System conversion, including storing patient registration data, diagnostic and procedure codes, and other files, is time consuming. As has been noted previously, the importance of leadership is crucial, and during the initial phase it is especially important to have at least one full-time person (either the practice administrator or a physician) who is fully committed to making sure that everyone is doing his or her job correctly, who is encouraging providers to fill out the new forms and to use the system correctly, and who is showing enthusiasm and commitment to the project. Without a committed person troubleshooting all the problems that come up, the system is unlikely to be implemented in an appropriate manner.

Comment

It is important to talk to other physicians who are also computer users in the community. Visits to other clinics, residency programs, or practices that have already worked through similar issues and problems are helpful and are still probably the best way to learn. A microcomputer at home also aids in familiarization before buying a system for the office. There are medical users groups for

some of the common, personal computers such as IBM and Apple, and there are electronic bulletin boards for physicians to exchange information. The proceedings of the annual meeting of the Society of Computer Applications in Medical Care (SCAMC)* provide an up-to-date reference for what is happening in the field of medical computing. Finally, the Society of Teachers of Family Medicine, the American Academy of Family Physicians, and the American Medical Association have task forces, committees, and departments on computer uses. The publications and reports of these groups offer wise advice. A bibliography of some representative references and books is included at the end of this paper.

Reference

1. Bobula JA: Introduction to computers. Presented at AAFP Residency Directors Workshop, Kansas City, Mo, June 7-9, 1982.

Suggested Reading

Books, Periodicals

Brandejs JF, Pace GC: Physicians' Primer on Computers, Lexington, Mass, Lexington Books, 1979

Computers and Medicine (published bimonthly by the American Medical Association, 535 N Dearborn St, Chicago, IL 60610. Issues No. 3 and 4 of 1980 contain a list of physicians' office software vendors)

Computing Physician, 515 Madison Avenue, New York, NY 10022 (newsletter that evaluates many available programs)

Consumer Reports (the September 1983 issue reviewed home and small business computers)

Day SB, Brandejs JF (eds): Computers for Medical Office and Patient Management. New York, Van Nostrand Reinhold, 1982

Dayhoff RE, Proceedings of the Sixth Annual Symposium on Computer Applications in Medical Care, Los Angeles, IEEE Computer Society, 1982

Hodge MH: Health Planning Review of Medical Information Systems. National Center for Health Services Research, Research Report Series, DHHS publication No. (PHS) 81-3303 (contains list of 155 known medical information system vendors). Available from National Technical Information Service, Springfield, Va

MD Computing, Springer-Verlag, 44 Hartz Way, Secaucus, NJ 07094 (new bimonthly magazine)

Medical Economics (issue of November 22, 1982, devoted to physicians' computer usage and evaluation)

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Given CW, Browne M, Sprakfa RJ, Breck EC: Evaluating primary ambulatory care with a health information system. J Fam Pract 12:293, 1981

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Rice CA, Godkin MA, Catlin RJO: Methodological, technical, and ethical issues of a computerized data system. J Fam Pract 10:1061, 1980

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*Address: IEEE Computer Society, PO Box 80452, Los Angeles, CA 90080

Appendix
Sample Questions to Ask Computer Vendors

1. How much information does the operator have to enter to record a charge(s) on an established patient?

2. What happens if the patient is a child in a divorced family, with the child living with the mother and the bills going to the father?

3. How long does it take to enter a new patient with three charges for the day? How long to enter a payment? (Does it take more than two seconds to go from one screen display to another?)

4. Can charges and payments be entered, using either the patient's account number or name?

5. How are adjustments handled?

6. What reports are produced at the end of the day?

7. What happens if they are out of balance?

8. Is there a delinquent balance report?

9. How easy is it for the operator to change a price for a given procedure?

10. What happens if the state Medicaid changes its form?

11. How much do statements cost?

12. How is backup handled?

13. Can messages be printed on statements?

14. How does one delete inactive patient accounts?